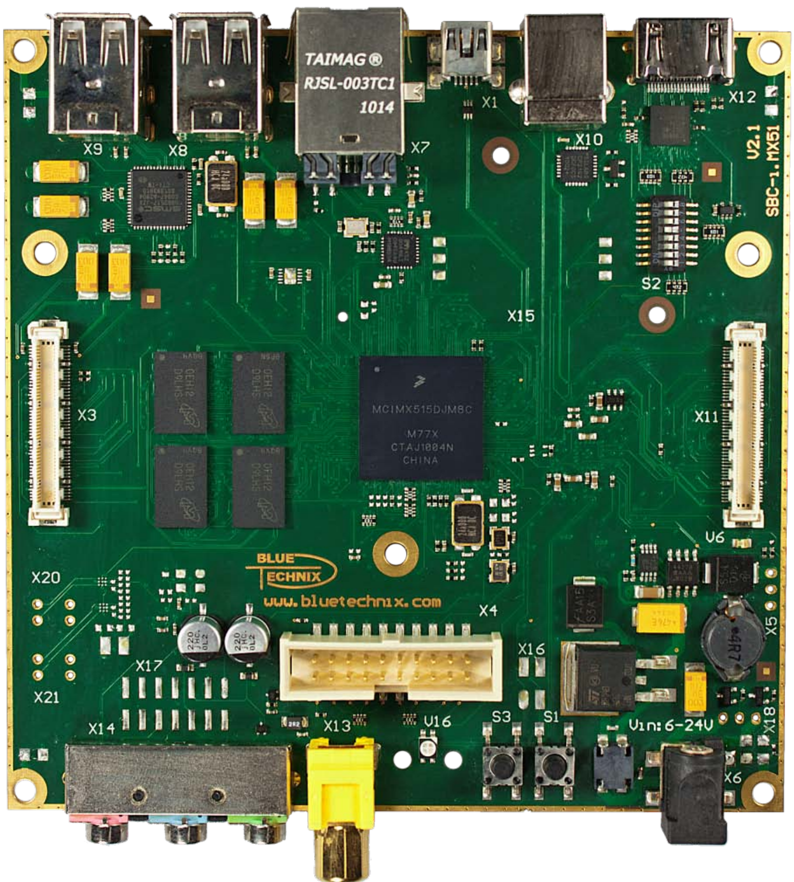


Hardware User Manual

SBC-i.MX51 V2.1

...maximum performance at minimum space

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Table of Contents

i.MX Core Modules....6
i.MX Development Boards....8
1 Introduction....9
1.1 Features....9
1.2 Block Diagram....10
1.3 Software....10
2 Components....11
2.1 Integrated Components....11
2.2 Optional Components....12
3 Standard I/O Connectors....13
3.1.1 Front side Connectors....14
3.1.2 Rear side Connectors....14
3.1.3 JTAG Connector....14
3.1.4 LED and Push Buttons....14
4 Extension Connectors....15
4.1 GPIO/Automation Connector (X3)....16
4.1.1 One-Wire-Interface....16
4.1.2 Analog-In....16
4.1.3 I^2C....16
4.1.4 Keypad....16
4.1.5 LEDs....17
4.1.6 PWM....17
4.1.7 SPI....17
4.1.8 SSI....17
4.1.9 UART....17
4.1.10 Power Supplies....18
4.1.11 I/O Power Domains....18
4.1.12 Pin Description Table....19
4.2 Digital Video Connector (X11)....20
4.2.1 Camera Sensor Interface Port (CSI1)....21
4.2.2 LCD Port (DISP2)....21
4.2.3 GPIOs....22
4.2.4 Power Supplies....22
4.2.5 Pin Description Table....23
4.3 Audio Connector (X17)....24
4.4 Reset / Power-On Connector (X16)....25

4.5 Power Supply Connector (X18) 25
5 Operating Conditions 26
5.1 ESD Sensitivity 26
5.2 Electrical Characteristics 26
5.3 Digital I/O Characteristics 26
5.4 Analog Inputs 27
5.5 Boot Mode Settings 27
5.6 Battery Operation 27
5.7 Backup Battery 27
6 Mechanical specification 28
6.1 Connector Locations 28
6.2 Mounting Hole Dimensions 29
7 Support 30
7.1 General Support 30
7.2 Board Support Packages 30
7.3 Product information 30
7.4 i.MX Software Support 30
7.4.1 Linux 30
7.4.2 Windows® CE 30
7.5 i.MX® Design Services 30
7.5.1 Upcoming Products and Software Releases 30
8 Ordering Information 31
9 Dependability 32
9.1 MTBF 32
10 Product History 33
10.1 Version Information 33
10.2 Anomalies 33
11 Document Revision History 34
12 List of Abbreviations 35
13 List of Figures and Tables 36

The information herein is given to describe certain components and shall not be considered as a guarantee of characteristics.

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Information

For further information on technology, delivery terms and conditions and prices please contact Bluetechnix (http://www.bluetechnix.com).

Warning

Due to technical requirements components may contain dangerous substances.

i.MX Core Modules

CM-i.MX27-C-C-Q26S128F32N512

The Core Module CM-i.MX27 is powered by Freescales' SoC i.MX27 (ARM 926 core, up to 400MHz). It addresses 128MB DDR-RAM, has an onboard NOR-flash of 32MByte and a NAND-flash with 512MByte at a size of 55x45mm.

CM-i.MX31-C-C-Q26S128F40N128-E

The Core Module CM-i.MX31 is powered by Freescales' SoC i.MX31 (ARM1136JF-S core, up to 532MHz). It addresses 128MB DDR-RAM, has an onboard NOR-flash of 40MByte and a NAND-flash with 128MByte at a size of 55x45mm. Core module is available as connector or BGA.

CM-i.MX53-C-I-Q24S1024F4N2048)

The Core Module CM-i.MX53 is powered by Freescales' SoC i.MX53 (ARM® Cortex™-A8, up to 1GHz). It addresses 1024MB DDR2-SDRAM, has an onboard NOR-flash of 4MByte and a NAND-flash with 2048MByte at a size of 80x45mm.

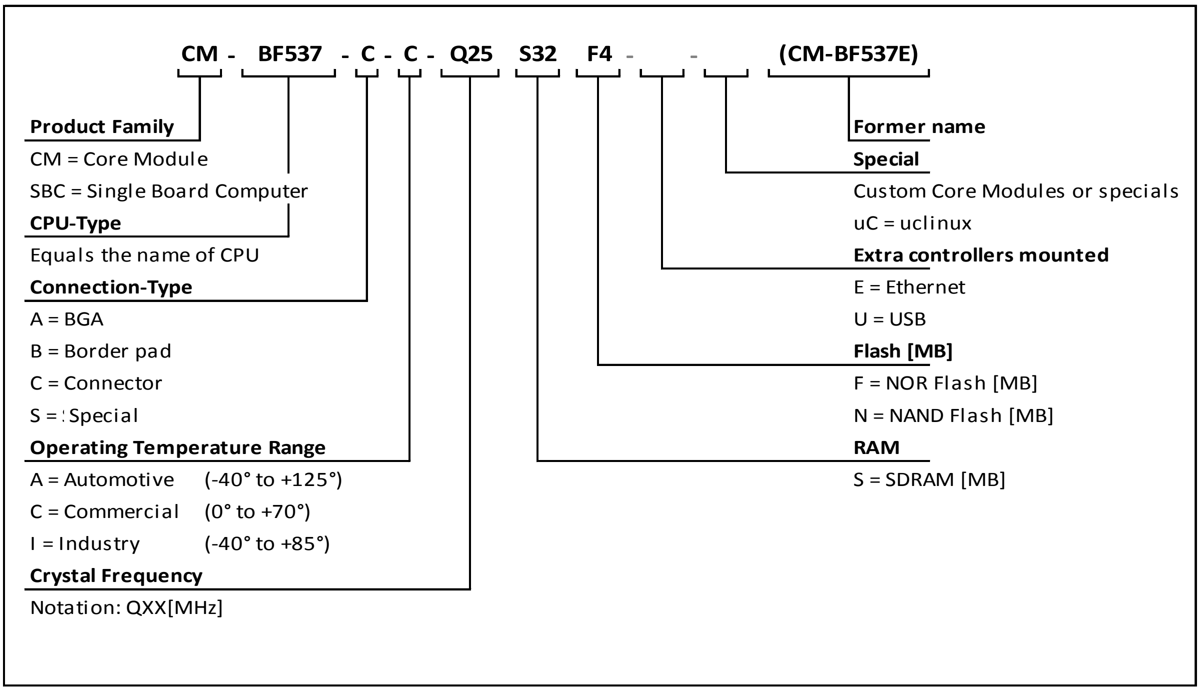
Core Module naming information

The idea is to put more Core Module specific technical information into the product name. New Core Module names will have following technical information covered in their names.

- Product Family,
- CPU-Type,
- Connection-Type,
- Operating Temperature Range,
- Crystal Frequency [MHz],
- RAM [MB],
- Flash [MB],
- External Controllers
- <u>Optional</u>
    - Special and/or
    - Former name

That expands of course the name but allows the customer to get the most important Core Module specific information at the first sight. Have a look at the example below to get an idea of the new Core Module names.

Example CM-BF537-C-C-Q25S32F4 (CM-BF537E)



i.MX Development Boards

DEV-i.MX27

The DEV-i.MX27 development board is an extendable development platform for the CM-i.MX27 processor modules. With display connector and keypad it can be used as a reference design for a low power mobile handheld device powered by a single Lithium Ion battery. The development board provides all interfaces of the connector version on dedicated expansion connectors. Extender boards can be plugged on top of the development board in order to enable additional interfaces.

DEV-iMX31

The DEV-i.MX31 Development Board is an extendable development platform for the CM-i.MX31 processor module. With display connector and keypad it can be used as a reference design for a low power mobile handheld device powered by a single Lithium Ion battery. The development board provides all interfaces of the connector version on dedicated expansion connectors. Extender boards can be plugged on top of the development board in order to enable additional interfaces.

SBC-i.MX51-S-C-Q24S512N2048

The Single-Board Computer SBC-i.MX51 is based on Freescale's high-performance i.MX51 mobile platform, incorporating an ARM Cortex-A8 CPU, an Image Processing Unit (IPUv3EX), a Video Processing Unit (VPU) and a Graphical Processing Unit (GPU). The IPUv3EX provides comprehensive support for connectivity to displays and cameras. The VPU supports hardware encoding and decoding of MPEG-4, H.263, H.264 and many more standards. The GPU serves 3D and 2Dacceleration in hardware. The board's memory capabilities (NAND Flash, DDR2) and numerous interfaces like Ethernet, HDMI,4xUSB and USB-OTG turn the SBC-i.MX51 into the ultimate development board for future high-end embedded devices.

DEV-i.MX53

The DEV-i.MX53 development board is an extendable development platform for the CM-i.MX53 processor module. The development board provides all interfaces of the connector version (Ethernet, HDMI,4xUSB and USB-OTG) on dedicated extender connectors. Extender boards can be plugged on top of the development board in order to enable additional interfaces.

Extender boards

Extender boards (EXT-SBC-i.MX51-) are expanding the development board SBC-i.MX51 by several interfaces and functionalities. Targeted application areas are: audio/video processing, security and surveillance, Ethernet access, positioning, automation and control, experimental development and measuring.

Note! Bluetechnix is offering tailored board developments as well.

1 Introduction

1.1 Features

The Single Board Computer SBC-i.MX51 is based on Freescale's high-performance i.MX51x mobile platform, incorporating an ARM Cortex-A8 CPU, an Image Processing Unit (IPUv3EX) and a Video Processing Unit (VPU). The IPUv3EX provides comprehensive support for the connectivity to displays and cameras. The VPU supports hardware encoding and decoding of MPEG-4, H.263 and H.264 videos. Its memory capabilities (NAND Flash, DDR2 SDRAM) and numerous interfaces turn the SBC-i.MX51 into the ultimate development board for future high-end embedded devices comparable to netbooks. Other target applications include industrial automation and control systems.

Figure 1-1 shows the board features.

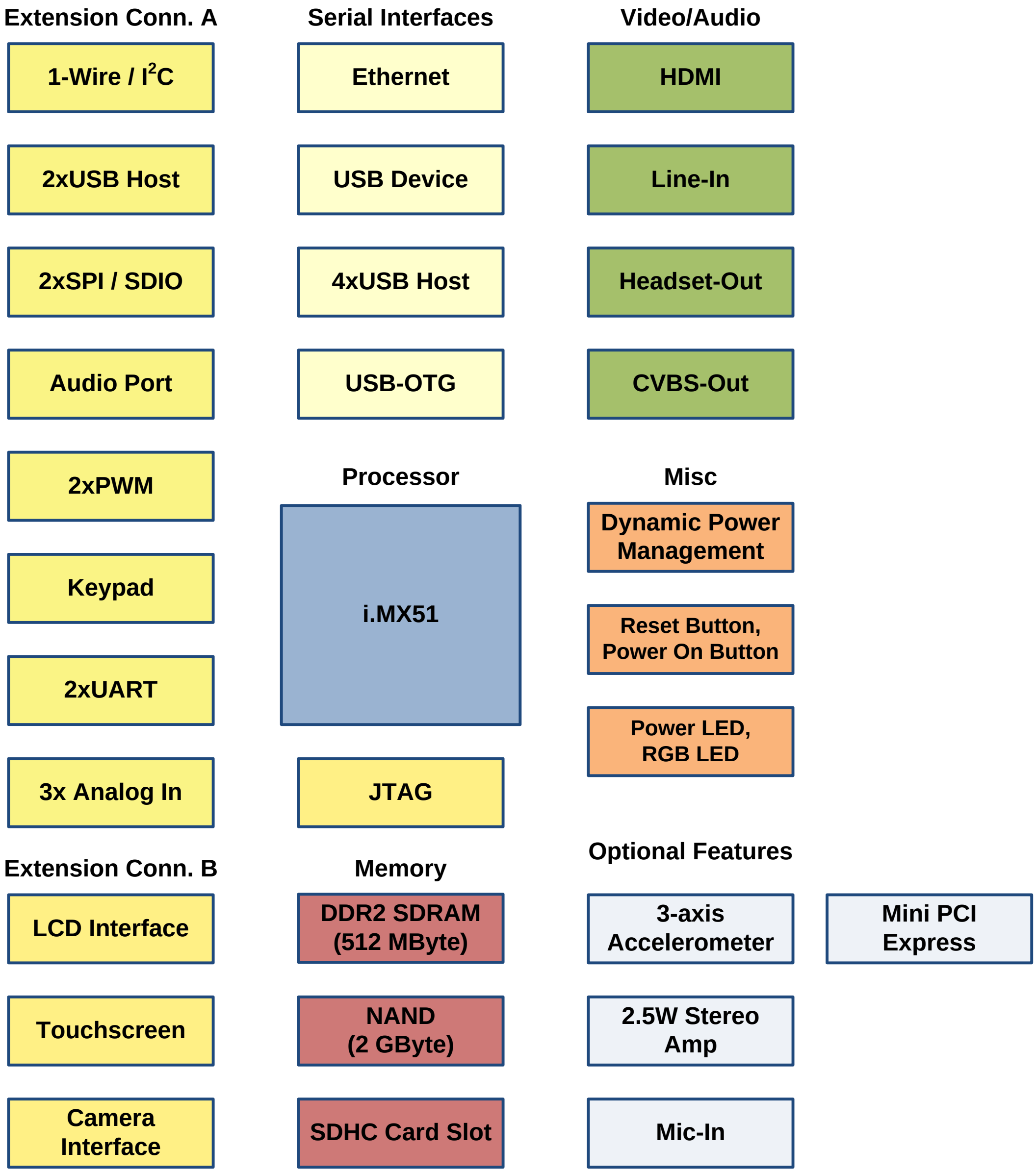


Figure 1-1: SBC-i.MX51 features

1.2 Block Diagram

Figure 1-2 shows the main components and connectors of the SBC-i.MX51.

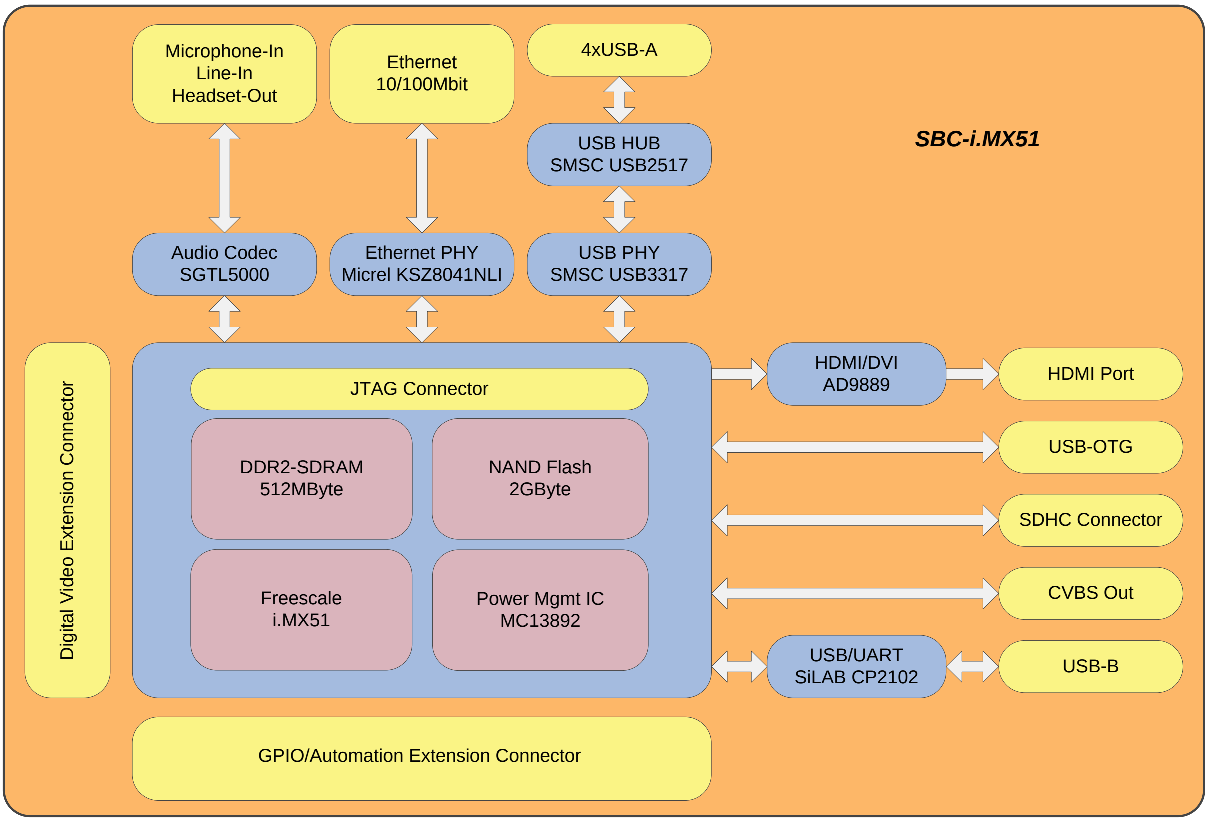


Figure 1-2: SBC-i.MX51 overview

1.3 Software

Bluetechnix provides a Linux Board Support Package (BSP) free of charge. A Windows CE Board Support Package is also available. Please note that there might be additional costs for the Windows CE BSP and licensing. Please contact Bluetechnix for more details.

For more information regarding the provided software please visit the Bluetechnix support site at http://support.bluetechnix.at/wiki. Please note that these pages are continuously updated throughout the product lifecycle.

2 Components

The SBC-i.MX51 features many peripherals to provide a lot of interfacing options. The next paragraphs give you a short overview of each component including a brief feature list. Please refer to the manufacturers' user manuals for more details.

2.1 Integrated Components

i.MX51 processor (Freescale, MCIMX515DJM8C)

The i.MX51 is a SoC for low power applications with an additional focus on multimedia.

- ARM Cortex A8 core
- 800 MHz core clock frequency
- 200 MHz DDR2 SDRAM interface
- Dynamic power management
- Hardware video codecs
- Powerful graphics acceleration (OpenGL and OpenVG)

i.MX Companion IC (Freescale, MC13892JVK)

The Power Management IC (PMIC) MC13892 is Freescale's companion IC for i.MX series CPUs. It generates all required power supplies, and contains some additional features:

- Dynamic power control system
- Battery charging control logic
- Octal 10-Bit ADC
- Single RGB LED driver
- Backlight LED driver
- Real Time Clock

DDR2 SDRAM (Micron, MT47H64M16HR-25)

- 512 MByte
- DDR2-800 (up to 800MB/s)

NAND Flash (Micron, MT29F16G08CBABAWP)

- 2GByte
- 8 Bit
- 4k page size

Ethernet Physical Transceiver (Micrel, KSZ8041)

- Ethernet/IEEE 802.3
- 10BaseT
- 100BaseTX
- MII Interface

USB Physical Transceiver (SMSC, USB3317)

- USB 2.0 Hi-Speed capable
- ULPI interface

USB HUB (SMSC, USB2517I)

- 7 port HUB
- USB 2.0 Hi-Speed capable
- Features Hi Speed, Full Speed and Low-Speed

USB to UART Bridge (SiLabs, CP2102)

- USB device
- Usable for terminal applications

HDMI Transmitter (Analog Devices, AD9889B)

- HDMI 1.1 compatible
- I^2S and SPDIF audio encoding

Audio Codec (Freescale, SGTL5000)

- Stereo Line In
- Stereo Line Out
- Microphone In (Mono, Electret or Dynamic microphones supported)

2.2 Optional Components

Some components are not mounted by default. If you want to use these components contact Bluetechnix for custom assembling.

These optional components are:

- 2.5W Stereo Audio Amp (National Semiconductors, 2x NCP2820) including connectors
- PCB Microphone (Knowles Acoustics, SPM0208HD5)
- 3-Axis Acceleration Sensor (Freescale, MMA7660FC)
- Mini-PCI type slot for Wi2Wi Wireless modules
- SIM-Card holder

3 Standard I/O Connectors

There are two types of connectors on the SBC-i.MX51: standard I/O Connectors and Extension Connectors. All standard I/O Connectors (except JTAG) are accessible on the front or rear side of the board (see Figure 3-1).

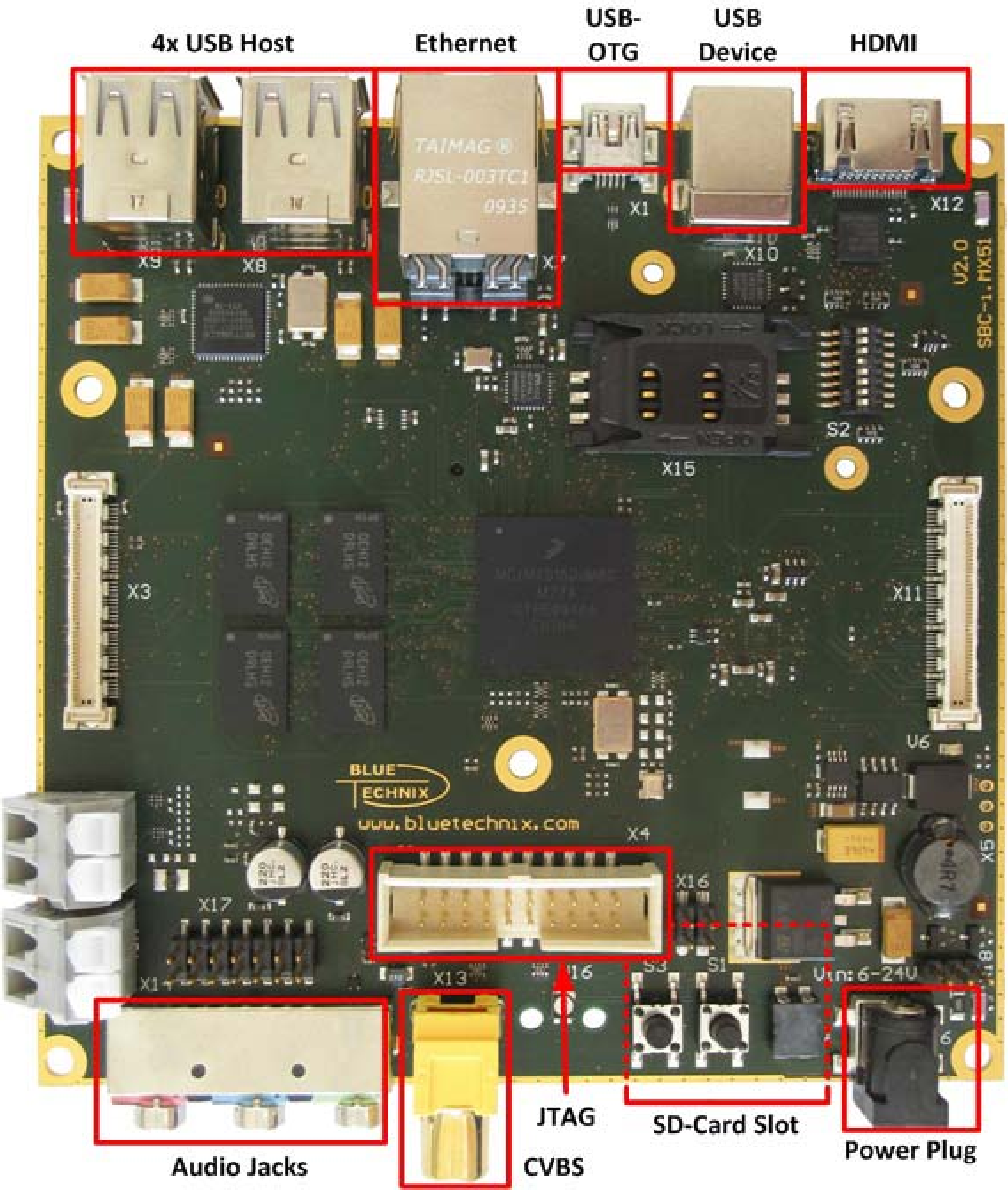


Figure 3-1: Standard interface positions

3.1.1 Front side Connectors

- Triple Audio Jack (Microphone-In, Line-In and Headset-Out)
- TV out (Composite)
- SD-card socket
- Power plug

3.1.2 Rear side Connectors

- 4x USB A (host connector)
- Ethernet
- Mini USB AB (USB-OTG connector)
- USB-B (device connector for terminal application)
- HDMI Display output

3.1.3 JTAG Connector

A standard ARM JTAG connector with 20 pins is available for debugging.

3.1.4 LED and Push Buttons

There are two push buttons and a single RGB-LED for user interaction. The RGB LED is connected to the MC18392 LED interface.

The push buttons have following functions:

- S1: RESET
- S3: Power On

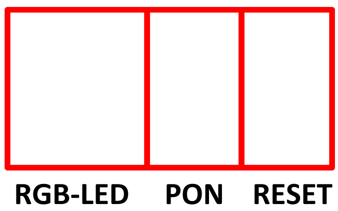


Figure 3-2: LED and button positions

If the SBC is enclosed in a chassis, you may mount a light pipe (515-1011F from DIALIGHT) above the RGB-LED for guiding the light to a front side panel.

4 Extension Connectors

The Extension Connectors enables the connection of additional hardware(e.g. Extender boards) to the SBC-i.MX51. Bluetechnix offers additional hardware for the SBC-i.MX51 such as a display, communication and experimental extender board. See our website for more information. (http://www.bluetechnix.com/goto/ext-sbc-i.mx51-ov)

All connector I/O pins are either connected to the i.MX or to the MC13892 (see pin description). Most of the pins connected to the i.MX have alternate functions; for more details see the Pin Description Tables and consult the i.MX51 datasheet.

The connectors for the GPIO- and Video Extension Connectors are FX10A-80P/8-SV1(71) from Hirose (mating part is FX10A-80S/8-SV(71)). All other connectors are standard 2.54mm-pitch headers.

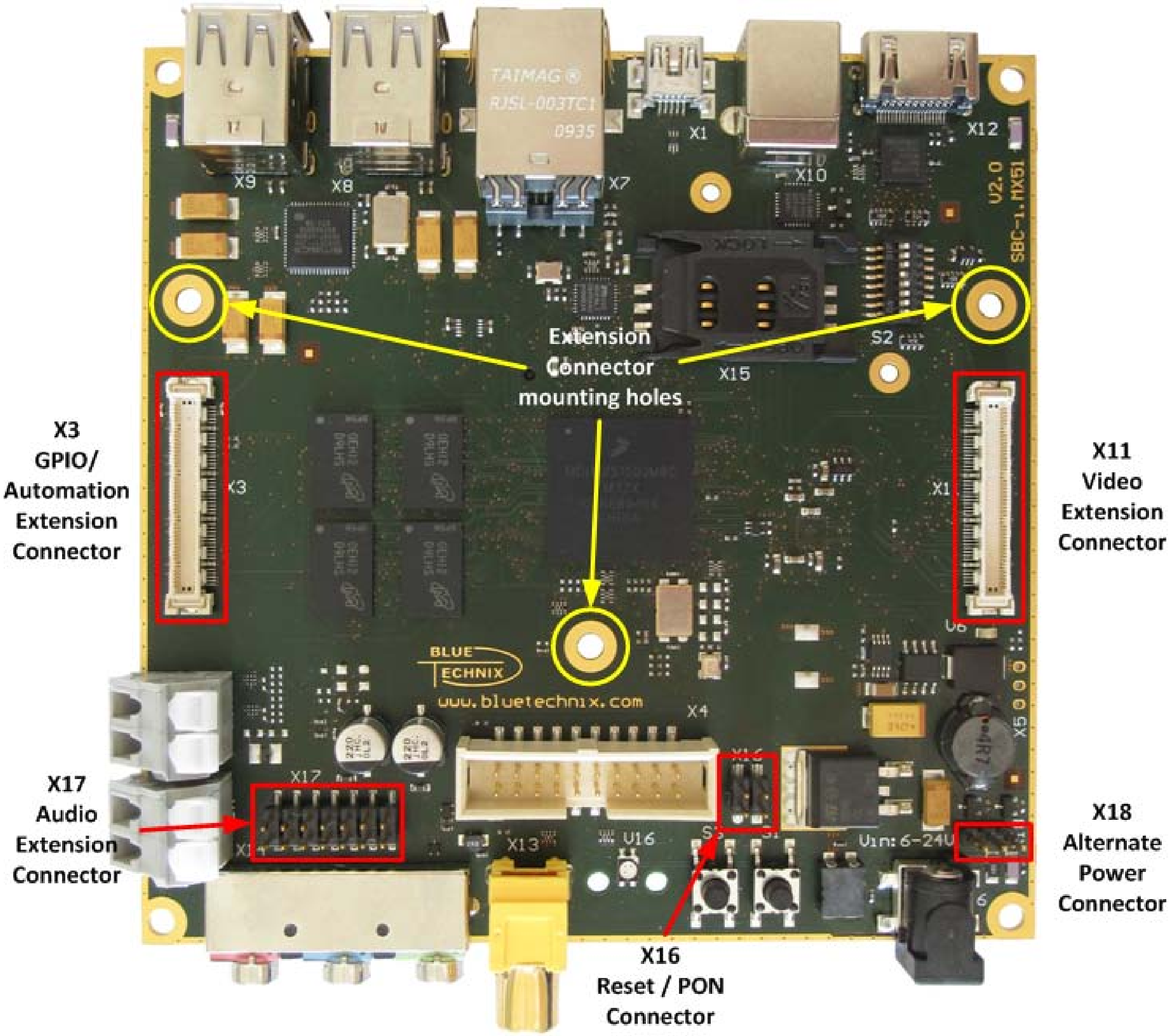


Figure 4-1: Extension Connector positions

4.1 GPIO/Automation Connector (X3)

The GPIO/Automation Extension Connector includes several serial interfaces, as well as a keypad, power-LED drivers and three analog inputs. See Figure 4-2 for a feature overview and Table 4-3 for a detailed pin description.

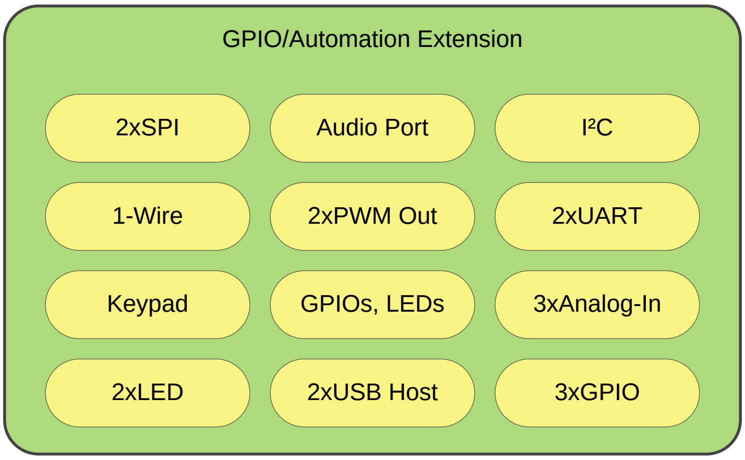


Figure 4-2: GPIO/Automation Extension Connector interfaces

4.1.1 One-Wire-Interface

The 1-Wire interface is available to communicate with a generic 1-Wire device defined by Maxim-Dallas.

4.1.2 Analog-In

Three 10-Bit analog-digital-converters (ADC) are available for general use. The inputs are connected to ADIN[5..7] on the MC13892 companion chip.

4.1.3 I²C

The two I²C serial busses allow the attachment of a variety of peripheral components to the GPIO/Automation Connector. Note that the I²C1 is shared with the CSPI1 Serial Peripheral Interface.

4.1.4 Keypad

The connector features keypad pins to connect a six-by-four button matrix keyboard to a designated interface of the i.MX51.

4.1.5 LEDs

The MC13892 features an auxiliary display LED driver output and a keypad LED driver output. Refer to the errata sheet of the MC13892 for problems which may appear when using this interface.

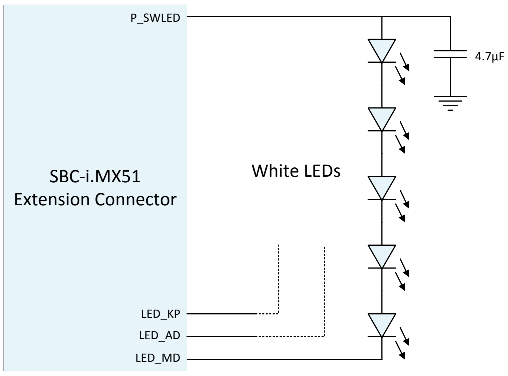


Figure 4-3: LED connection circuit

4.1.6 PWM

Two PWM outputs are available on the GPIO/Automation Extension Connector. Please note that the PWM1 is also present on the Video Extension Connector.

4.1.7 SPI

Two Serial Peripheral Interfaces are available on the connector. The CSPI1 interface is shared with the I^2C1 and provides two slave select signals, the CSPI2 is shared with the SD-card interface, and provides only a single slave select signal.

4.1.8 SSI

This interface can be used as alternate digital audio channel and is connected to the AUD4 interface of the i.MX51.

4.1.9 UART

The signals of the UART2 and UART3 are available on the extension connector for the connection of a variety of peripheral devices.

4.1.10 Power Supplies

The GPIO/Automation Extension Connector provides different supply voltages. They can be used on a custom extension board. Some supply voltages are generated by the MC13892 and can be set to different values. They must be set and enabled first, by configuring the companion IC. The following table shows the maximum supply current for each voltage domain.

Signal Name	Voltage	Maximum Supply Current
P_5V0	5.0V	500mA[3)]
P_VIOHI[1)]	2.775V	50mA[3)]
P_SW4[1)]	1.8V	50mA[3)]
P_GEN2[1)]	3.15V	70mA
P_AUDIO	2.3V, 2.5V, 2.775V, 3.0V	150mA
P_VIDEO	2.5V, 2.6V, 2.7V, 2.775V	350mA
P_SWLED[2)]	4.3V to 26.5V	60mA

Table 4-1: Maximum power consumption for the GPIO / automation connector supplies

[1)] It is not advisable to alter these voltages; otherwise the board may get damaged.
[2)] The P_SWLED voltage drives the LEDs connected to the LED-driver pins. The output voltage will be set automatically by the MC13892. For LED connectivity see Figure 4-3. Please also refer to the MC13892 errata sheet available from the Freescale website.
[3)] Be aware that this power supply is available on both extension connectors and this is the maximum current that can be drawn altogether.

4.1.11 I/O Power Domains

All digital I/O pins belong to one of three available power domains: P_SW4 (1.8V), P_VIOHI (2.775V) or P_GEN2 (3.15V). The following table shows each interface with the corresponding voltage level.

Interface	Pins	Power Domain	Description
1-Wire	1	P_VIOHI	OWIRE
I^2C2	2	P_VIOHI	I2C2.SCL, I2C2.SDA
Keypad	10	P_SW4	KPP.COL[0..5], KPP.ROW[0..3]
PWM	2	P_VIOHI	PWM1, PWM2
SD	6	P_GEN2	SD2.CMD, SD2.CLK, SD2.D0, SD2.D1, SD2.D2, SD2.D3
SPI	6	P_SW4	CSPI1.MOSI, CSPI1.MISO, CSPI1.SS0, CSPI1.SS1, CSPI1.RDY, CSPI1.SCLK
SSI	6	P_VIOHI	AUD4.RFS, AUD4.RSCK, AUD4.Tx, AUD4.Rx, AUD4.TSCK, AUD4.TFS
UART	4	P_VIOHI	UART2.TXD, UART2.RXD, UART3.TXD, UART3.RXD
PON	1	Open Drain	A_CTRL.PON1 – Power down Power Mgmt.
ADIN	3	-	ADC Input on MC13892
LED	2	P_SWLED	LED driver outputs

Table 4-2: Power domains for I/O

4.1.12 Pin Description Table

Pin No	Signal	Type	Description
1	VUSB6	PWR	Power Supply
2	GND	PWR	Power Ground
3	GND	PWR	Power Ground
4	USBH6.D_P	IO	USB D+
5	USBH6.D_N	IO	USB D-
6	P_SWLED	PWR	Power Supply
7	LED_AD	O	LED driver output connected to MC18392
8	LED_KP	O	LED driver output connected to MC18392
9	GND	PWR	Power Ground
10	ADIN5	I	Analog input connected to MC18392
11	ADIN6	I	Analog input connected to MC18392
12	ADIN7	I	Analog input connected to MC18392
13	GND	PWR	Power Ground
14	P_GEN2	PWR	Power Supply
15	SD2_CMD	IO	SD-card interface or CSPI_MOSI
16	SD2_CLK	O	SD-card interface or CSPI_SCLK
17	SD2_D0	IO	SD-card interface
18	SD2_D1	IO	SD-card interface
19	SD2_D2	IO	SD-card interface
20	SD2_D3	IO	SD-card interface or CSPI_SS2
21	GND	PWR	Power Ground
22	CSPI1_SCLK	IO	SPI1 usable as I2C1_SCL or GPIO4_27
23	CSPI1_MOSI	IO	SPI1 usable also as I2C1_SDA or GPIO4_22 *NOTE: I^2C1 is connected to several components at the SBC-i.MX51*
24	CSPI1_MISO	I	SPI1 usable also as GPIO4_23
25	CSPI1_SS0	O	SPI1 usable also as GPIO4_24
26	CSPI1_SS1	O	SPI1 usable also as GPIO4_25
27	CSPI1_RDY	I	SPI1 usable also as GPIO4_26
28	P_SW4_1V8	PWR	Power Supply
29	GND	PWR	Power Ground
30	AUD4_RFS	IO	Audio Port 4 usable also as GPIO2_0
31	AUD4_RSCK	IO	Audio Port 4 usable also as GPIO2_3
32	AUD4_TX	O	Audio Port 4 usable also as GPIO2_4
33	AUD4_RX	I	Audio Port 4 usable also as GPIO2_5
34	AUD4_TSCK	IO	Audio Port 4 usable also as GPIO2_6
35	AUD4_TFS	IO	Audio Port 4 usable also as GPIO2_7

Pin No	Signal	Type	Description
36	P_VIOHI	PWR	Power Supply
37	P_AUDIO	PWR	Power Supply
38	GND	PWR	Power Ground
39	GND	PWR	Power Ground
40	GND	PWR	Power Ground
41	P_5V0	PWR	Power Supply
42	P_5V0	PWR	Power Supply
43	P_5V0	PWR	Power Supply
44	P_VIDEO	PWR	Power Supply
45	P_SW4_1V8	PWR	Power Supply
46	KPP_COL5	I	Keypad Column
47	KPP_COL4	I	Keypad Column
48	KPP_COL3	I	Keypad Column
49	KPP_COL2	I	Keypad Column
50	KPP_COL1	I	Keypad Column
51	KPP_COL0	I	Keypad Column
52	KPP_ROW3	I	Keypad Row
53	KPP_ROW2	I	Keypad Row
54	KPP_ROW1	I	Keypad Row
55	KPP_ROW0	I	Keypad Row
56	P_VIOHI	PWR	Power Supply
57	GPIO1_3	IO	GPIO with PWM2 functionality
58	GPIO1_2	IO	GPIO with PWM1 functionality
59	GND	PWR	Power Ground
60	GPIO1_6	IO	General Purpose Input or Output
61	GPIO1_8	IO	General Purpose Input or Output
62	GPIO1_9	IO	General Purpose Input or Output
63	NC		Not Connected
64	NC		Not Connected
65	NC		Not Connected
66	UART3_TXD	I	UART TxD or GPIO 1_23
67	UART3_RXD	I	UART RxD or GPIO 1_22
68	UART2_TXD	O	UART TxD or GPIO 1_21
69	UART2_RXD	I	UART RxD or GPIO 1_20
70	GND	PWR	Power Ground
71	OWIRE_LINE	IO	One-wire interface
72	I2C2_SDA	IO	usable as I2C2_SDA or GPIO2_8
73	I2C2_SCL	IO	usable as I2C2_SCL or GPIO2_9
74	GND	PWR	Power Ground
75	A_CTRL_PON1	I_u	Power On Input
76	USBH7.D_N	IO	USB D-
77	USBH7.D_P	IO	USB D+
78	GND	PWR	Power Ground
79	GND	PWR	Power Ground
80	VUSB7	PWR	Power Supply

Table 4-3: GPIO / automation connector pin description

4.2 Digital Video Connector (X11)

The Video Extension Connector is designed to add a custom video extension board with user-defined camera and display components, e.g. a CMOS sensor and a LCD display.

Additionally, some GPIOs are available for configuring the interface and handshaking. Touch screen functionality can be implemented by connecting four analog lines, which are routed to the MC13892, to an appropriate display.

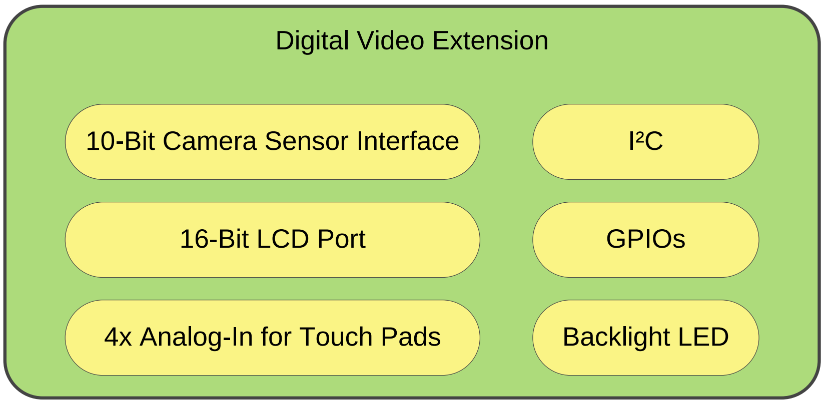


Figure 4-4: Digital video connector

4.2.1 Camera Sensor Interface Port (CSI1)

A camera (e.g. an OmniVision OV2655) can be connected to the SBC-i.MX51x board using the CMOS Sensor Interface 1 (CSI1).

Interface	Pins	Power Domain	Description
CSI1_Data	10	P_SW4	CSI1.D0 - CSI1.D9
CSI1_Control	5	P_SW4	CSI1.VSYNC, CSI1.HSYNC, CSI1.PIXCLK, CSI1.MCLK, CSI1.PWDN
I²C1	2	P_SW4	I2C1.SDA, I2C1.SCL

Table 4-4: CSI1 interface description

4.2.2 LCD Port (DISP2)

The DISP2 interface is available to connect an LCD display to the SBC-i.MX51 board. On the secondary display port, the i.MX51 supports resolutions up to 1280X720. Limitations may apply when using both display interfaces simultaneously.

Interface	Pins	Power Domain	Description
DISP2_Data	16	P_VIOHI	DISP2.D0 – DISP2.D15
DISP2_Control	3	P_VIOHI	DISP2.VSYNC, DISP2.HSYNC, DISP2.CLK
DISP2_Control	1	P_SW4	DISP2.DE
PWM	2	P_VIOHI	PWM1, TFT.PWRCTRL - Contrast
LED	2	P_SWLED	LED.MD - Display Backlight
ADIN	4	-	ADIN[1..4] – Touch screen

Table 4-5: DISP2 interface description

4.2.3 GPIOs

Some additional GPIOs can be used as control signals for either the camera or the display interface.

Interface	Pins	Power Domain	Description
GPIO3_x	5	P_SW4	General Purpose IO
GPIO2_20	1	P_VIOHI	General Purpose IO
GPIO1_2	1	P_VIOHI	General Purpose IO / PWM1_OUT

Table 4-6: GPIO Power Domains

4.2.4 Power Supplies

The Video Extension Connector provides six different supply voltages. They can be used for a custom extension board. Some supply voltages are generated by the MC13892 and can be set to different values. They must be set and enabled first, by configuring the companion IC. The following table shows the maximum supply current for each voltage.

Signal Name	Voltage	Maximum Current
P_5V0	5.0V	500mA[3)]
P_SW4[1)]	1.8V	50mA[3)]
P_GEN3	1.8V, 2.9V	50mA[3)]
P_DIG	1.05V, 1.25V, 1.65V, 1.8V	50mA
P_CAM	2.5V, 2.6V, 2.75V, 3.0V	250mA
P_SWLED[2)]	4.3V to 26.5V	60mA

Table 4-7: Maximum power consumption for the digital video connector supplies

[1)] It is not advisable to alter these voltages; otherwise the board may get damaged.
[2)] The P_SWLED voltage drives the LEDs connected to the LED-Driver Pins. The output voltage will be set automatically by the MC13892. For LED connectivity, see Figure 4-3. Please also refer to the MC13892 errata sheet available from the Freescale website.
[3)] Be aware that this power supply is available on both extension connectors and this is the maximum current that can be drawn altogether.

4.2.5 Pin Description Table

Pin No	Signal	Type	Description
1	GND	PWR	Power Ground
2	GND	PWR	Power Ground
3	GND	PWR	Power Ground
4	NC	NC	Not Connected
5	NC	NC	Not Connected
6	P_VIOHI	PWR	Power Supply
7	DISP2_DAT1	O	Display Port 2 Data
8	DISP2_DAT3	O	Display Port 2 Data
9	DISP2_DAT5	O	Display Port 2 Data
10	DISP2_DAT7	O	Display Port 2 Data
11	GND	PWR	Power Ground
12	DISP2_DAT9	O	Display Port 2 Data
13	DISP2_DAT11	O	Display Port 2 Data
14	DISP2_DAT13	O	Display Port 2 Data
15	DISP2_DAT15	O	Display Port 2 Data
16	DI2_PIN2	O	Display Port 2 HSYNC
17	DI_GP4	O	Display Port 2 Data Enable
18	GND	PWR	Power Ground
19	DISPB2_SER_DIO	IO	usable as GPIO3_6
20	DISPB2_SER_CLK	IO	usable as GPIO3_7
21	DISPB2_SER_RS	IO	usable as GPIO3_8
22	GPIO1_2	IO	GPIO with PWM functionality
23	GND	PWR	Power Ground
24	ADIN2	I	Analog input for touch pad usage connected to MC18392
25	ADIN1	I	Analog input for touch pad usage connected to MC18392
26	CSPI1_MOSI	IO	I2C1_SDA
27	CSPI1_SCLK	IO	I2C1_SCL
28	CSI1_D10	I	CMOS sensor interface 1 Data
29	CSI1_D12	I	CMOS sensor interface 1 Data
30	CSI1_D14	I	CMOS sensor interface 1 Data
31	CSI1_D16	I	CMOS sensor interface 1 Data
32	CSI1_D18	I	CMOS sensor interface 1 Data
33	CSI1_VSYNC	I	CMOS sensor interface 1 VSYNC
34	CSI1_HSYNC	I	CMOS sensor interface 1 HSYNC
35	CSI1_D8	O	usable as GPIO3_12 (e.g. Power Down)
36	P_CAM	PWR	Power Supply
37	P_GEN3	PWR	Power Supply
38	GND	PWR	Power Ground
39	GND	PWR	Power Ground
40	GND	PWR	Power Ground
41	P_5V0	PWR	Power Supply
42	P_5V0	PWR	Power Supply
43	P_5V0	PWR	Power Supply
44	P_DIG	PWR	Power Supply
45	P_SW4	PWR	Power Supply
46	GND	PWR	Power Ground
47	CSI1_MCLK	O	CMOS sensor interface 1 Master Clock
48	CSI1_PIXCLK	I	CMOS sensor interface 1 Pixel Clock
49	GND	PWR	Power Ground
50	CSI1_D19	I	CMOS sensor interface 1 Data
51	CSI1_D17	I	CMOS sensor interface 1 Data

Pin No	Signal	Type	Description
52	CSI1_D15	I	CMOS sensor interface 1 Data
53	CSI1_D13	I	CMOS sensor interface 1 Data
54	CSI1_D11	I	CMOS sensor interface 1 Data
55	GND	PWR	Power Ground
56	ADIN3	I	Analog input for touch pad usage connected to MC18392
57	ADIN4	I	Analog input for touch pad usage connected to MC18392
58	GND	PWR	Power Ground
59	EIM_A26	IO	usable as GPIO2_20
60	LED_MD	O	LED driver output connected to MC18392
61	P_SWLED	PWR	LED Power Supply
62	DISPB2_SER_DIN	IO	usable as GPIO3_5
63	GND	PWR	Power Ground
64	DI2_PIN3	O	Display Port 2 VSYNC
65	DI2_DISP_CLK	O	Display Port 2 Clock
66	DISP2_DAT14	O	Display Port 2 Data
67	DISP2_DAT12	O	Display Port 2 Data
68	DISP2_DAT10	O	Display Port 2 Data
69	DISP2_DAT8	O	Display Port 2 Data
70	GND	PWR	Power Ground
71	DISP2_DAT6	O	Display Port 2 Data
72	DISP2_DAT4	O	Display Port 2 Data
73	DISP2_DAT2	O	Display Port 2 Data
74	DISP2_DAT0	O	Display Port 2 Data
75	GND	PWR	Power Ground
76	NC	NC	Not Connected
77	NC	NC	Not Connected
78	RFU	RFU	Reserved For Future Use
79	RFU	RFU	Reserved For Future Use
80	RFU	RFU	Reserved For Future Use

Table 4-8: Digital video connector pin description

4.3 Audio Connector (X17)

This extension connector contains the analog audio signals, as well as an SPDIF interface. This connector is also compatible with some Nano-ITX chassis.

Pin No	Description	Pin No	Description
1	SPDIF	**2**	P_5V0
3	GND	**4**	NC
5	Headphone right	**6**	Headphone left
7	Line in right	**8**	Line in left
9	NC	**10**	Microphone in
11	NC	**12**	NC
13	GND	**14**	GND

Table 4-9: Audio extension connector pin description

4.4 Reset / Power-On Connector (X16)

Not mounted at standard SBC-i.MX51.

The two signals Power-On and Reset are accessible via this connector. These signals are the same as the ones routed to the two push buttons.

Pin No	Signal	Description
1	PON1	Power On (internally pulled up)
2	GND	Signal ground
3	POR	Power On Reset (internally pulled up)
4	GND	Signal ground

Table 4-10: Reset / Power-on connector pin description

4.5 Power Supply Connector (X18)

Not mounted at standard SBC-i.MX51.

The alternate Power Supply Extension Connector provides the possibility to power the board via a 3-pin header.

Pin No	Signal	Description
1	GND	Power Ground
2	PDI	Power Detect Input (leave open if unused)
3	VIN	Power Supply

Table 4-11: Power supply extension connector pin description

5 Operating Conditions

This section provides the operating conditions for the SBC-i.MX51 Single Board Computer.

5.1 ESD Sensitivity



ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

5.2 Electrical Characteristics

Parameter	Symbol	Min	Typ.	Max	Unit
Main Power Supply Voltage	VIN	6.0	12.0	24.0	V
Board Power Consumption 1)		-	3.5	10	W
Operating Temperature 2)		0	-	70	°C
Processor Clock Frequency	CPUCLK	-	-	800	MHz
USB Supply Voltage	VUSBx	4.5	5.0	5.5	V
USB Supply Current	VUSBx	-	-	500	mA
Extender Supply Voltage	P_5V0	4.5	5.0	5.5	V
Extender Supply Current	P_5V0	-	-	500	mA

Table 5-1: Operating conditions

1) The Power consumption refers to a single board, with no Extension Boards or USB-Devices plugged in

2) The board is equipped with components specified for consumer temperature range. Please consult Bluetechnix for appropriate industrial assembling.

5.3 Digital I/O Characteristics

Most IO pins available on the Extension Connectors (X3 and X11) are connected to the i.MX, and are assigned to one of three power domains.

Parameter	Power Domain	Symbol	Min	Typ.	Max	Unit
High-Level Output Voltage	P_VIOHI	V_{oh}	2.625	2.775	3.075	V
High-Level Output Voltage	PGEN2	V_{oh}	3.0	3.15	3.45	V
High-Level Output Voltage	P_SW4	V_{oh}	1.65	1.8	2.1	V
Low-Level Output Voltage	all domains	V_{ol}	-	-	0.15	V
High Level Output Current	all domains	I_{oh}	1.9	-	6.6	mA
Low-Level Output Current	all domains	I_{ol}	1.9	-	6.6	mA
High-Level Input Voltage	P_VIOHI	V_{ih}	1.95	-	2.775	V
Low -Level Input Voltage	P_VIOHI	V_{il}	0	-	0.83	V
High-Level Input Voltage	PGEN2	V_{ih}	2.21	-	3.15	V
Low-Level Input Voltage	PGEN2	V_{il}	0	-	0.94	V
High -Level Input Voltage	P_SW4	V_{ih}	1.26	-	1.8	V
Low -Level Input Voltage	P_SW4	V_{il}	0	-	0.54	V

Table 5-2: Digital IO characteristics

5.4 Analog Inputs

The 10-bit ADC, which is integrated in the MC13892, allows measuring analog voltages. These analog inputs are mainly used for touchpad sensing or voltage (battery) monitoring.

Parameter	Symbol	Min	Typ.	Max	Unit
Resolution			10		Bit
Conversion Current	I_c		1		mA
Conversion Core Input Voltage	V_{in}	0	-	2.4	V
Conversion Time Per Channel	t_c			10	µs

Table 5-3: ADC characteristics

5.5 Boot Mode Settings

The SBC supports three different boot modes. For USB/UART boot mode, the i.MX51 is polling for activity on both USBOTG and UART1. To get a more detailed explanation please see the software documentation at http://support.bluetechnix.at/wiki/SBC

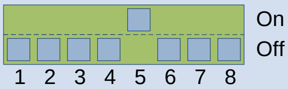
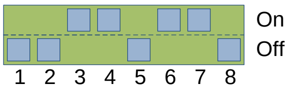
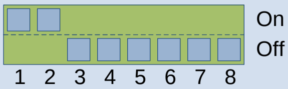
Mode	Boot Switch Setting	Boot Media
1		SD Card
2		NAND Flash
3		USBOTG **or** UART1 (UART-USB-Bridge)

Table 5-4: Boot modes

5.6 Battery Operation

The SBC-i.MX51 is not designed for battery operation. Anyhow there is a possibility to connect a Li-Ion or LiPo-battery to the Board, with some small board modifications. If you want to do this, please contact Bluetechnix for support.

5.7 Backup Battery

There is also a possibility to add a 6.8mm rechargeable or non-rechargeable lithium coin cell to keep the RTC running and the RAM self-refreshing. The SBC is delivered only with a 6.8mm coin cell holder but without battery.

6 Mechanical specification

This section shows the position of all connectors and mounting holes.

6.1 Connector Locations

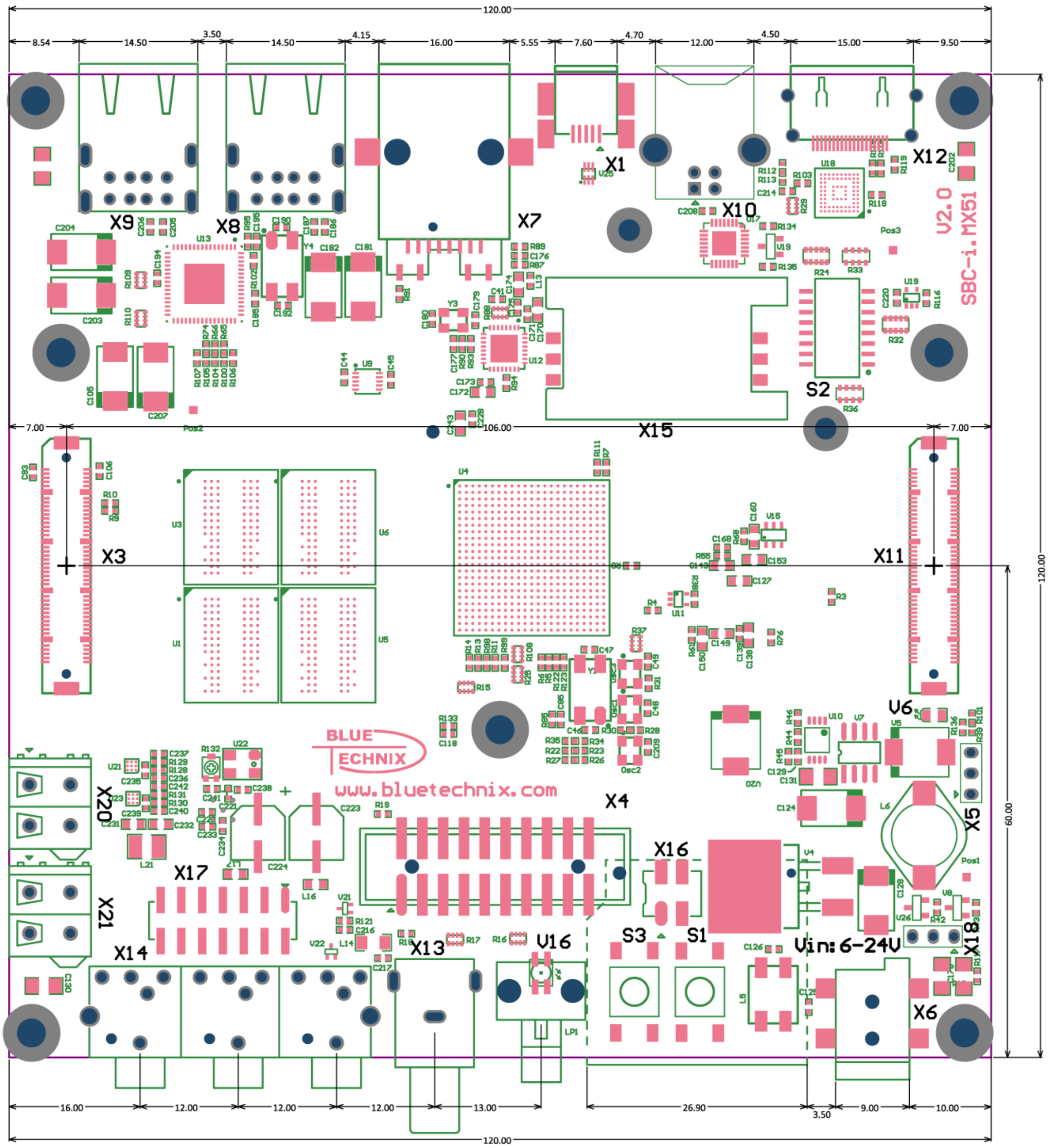


Figure 6-1: Connector dimensions

6.2 Mounting Hole Dimensions

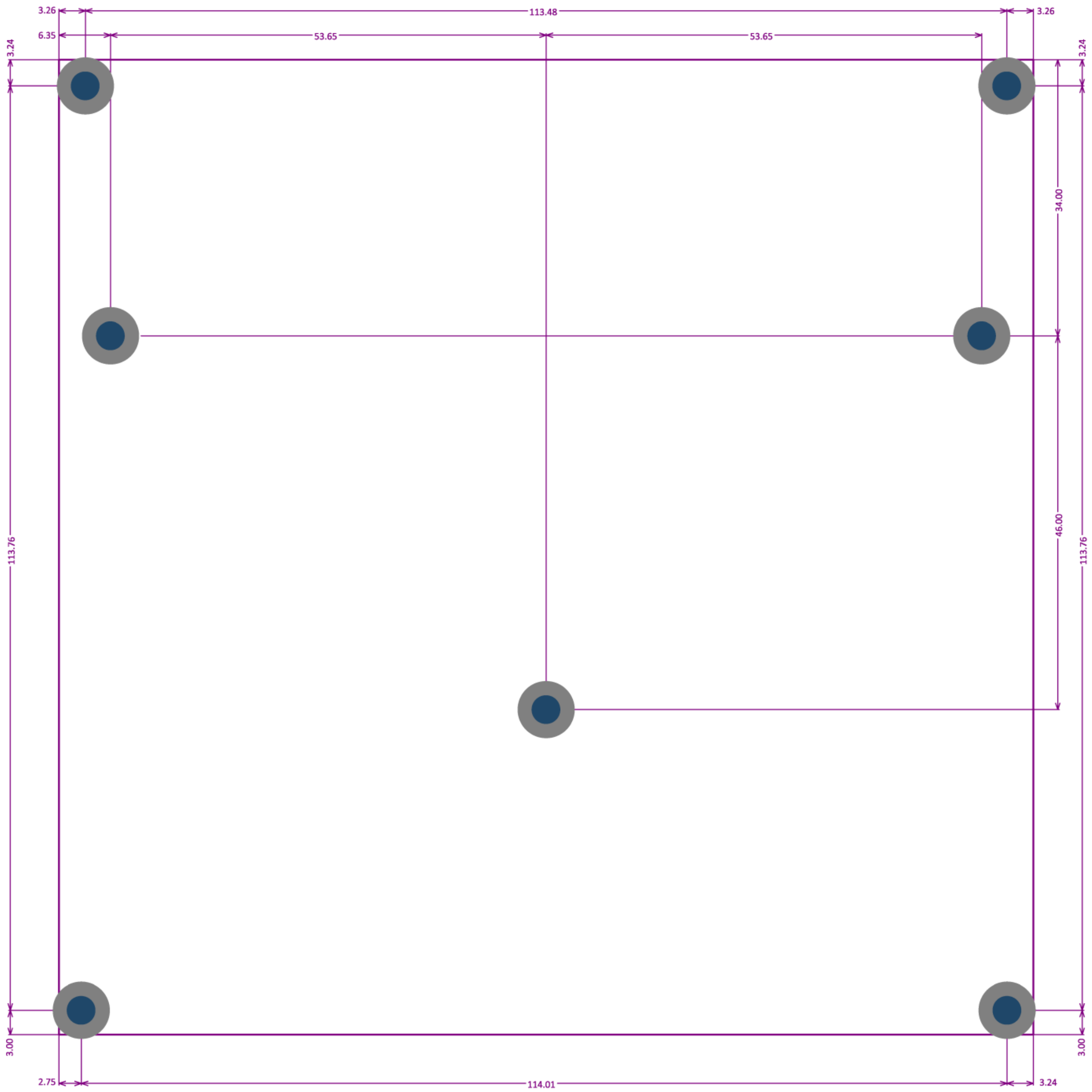


Figure 6-2: Mounting-hole dimensions

7 Support

7.1 General Support

General support for products can be found at Bluetechnix' support site https://support.bluetechnix.at/wiki

7.2 Board Support Packages

Board support packages and software downloads can be downloaded at

https://support.bluetechnix.at/wiki/SBC

7.3 Product information

For the latest product change information, please consult the product web page http://www.bluetechnix.com/goto/sbc-i.mx51

If you want to know in detail, which components are mounted on your board, please see the production information on our wiki page

https://support.bluetechnix.at/wiki/Hardware_documentation_%28SBC-i.MX51%29

7.4 i.MX Software Support

7.4.1 Linux

Linux BSP and images of derivates can be found at Bluetechnix' support site https://support.bluetechnix.at/wiki at the software section of the related product.

7.4.2 Windows® CE

You can get a Windows Embedded CE 6.0 BSP for the SBC-i.MX51 from Adeneo Embedded at

http://www.adeneo-embedded.com/Products/Board-Support-Packages/Bluetechnix

7.5 i.MX® Design Services

Based on more than seven years of experience with Blackfin and i.MX, Bluetechnix offers development assistance as well as custom design services and software development.

7.5.1 Upcoming Products and Software Releases

Keep up to date with all product changes, releases and software updates of Bluetechnix at http://www.bluetechnix.com.

8 Ordering Information

Article Number	Name	Description
100-4110-2	SBC-i.MX51-S-C-Q24S512N2048	Single-Board Computer SBC-i.MX51
100-2520-2	EXT-SBC-i.MX51-EXP	Experimental Extender Board for SBC-i.MX51
100-2523-1	EXT-SBC-i.MX51-DISP	Display Extender Board for SBC-i.MX51
100-2524-1	EXT-SBC-i.MX51-COMM	Communication Extender Board for SBC-i.MX51

Table 8-1 - Ordering information

NOTE: Custom hard and software developments are available on request! Please contact Bluetechnix (office@bluetechnix.com) if you are interested in custom hard- and software developments.

9 Dependability

9.1 MTBF

Please keep in mind that a part stress analysis would be the only way to obtain significant failure rate results, because MTBF numbers just represent a statistical approximation of how long a set of devices should last before failure. Nevertheless, we can calculate an MTBF of the SBC-i.MX51 using the bill of material. We take all the components into account. The PCB and solder connections are excluded from this estimation. For test conditions we assume an ambient temperature of 30°C of all SBC-i.MX51 components except the i.MX® processor (80°C) and the memories (70°C). We use the MTBF Calculator from ALD (http://www.aldservice.com/) and use the reliability prediction MIL-217F2 Part Stress standard. Please get in touch with Bluetechnix (office@bluetechnix.com) if you are interested in the MTBF result.

10 Product History

10.1 Version Information

Version	Type	Changes
2.1	Connector Type	The two expansion connectors have been changed to a FX10-80S from Hirose for better signal integrity and more flexibility
2.1	Connector Position	The 4 USB-Host jacks and the RJ45 jack have been exchanged
2.1	Assembling Option	The TV-Out jack is populated in this version
1.2	Initial release	First SBC release

Table 10-1: Overview product changes

10.2 Anomalies

Version	Date	Description
2.1	2011-08-22	I2C-1 pullups could be overdimensioned. In such cases, certain voltage might not be available since the i.MX51 cannot communicate with the power management IC (MC13892). A fix for this issue is provided by replacing two resistors (currently populated: 4k7, new value: 1k5). This will be fixed starting with revision 2.2 and all devices delivered after 2011/08/22. https://support.bluetechnix.at/wiki/Known_Issues_(SBC-i.MX51)
2.1	2010-12-22	It is recommended to take care of active cooling when multiple USB devices are attached, HDMI is active and you are using supply voltages above $16V_{DC}$.
2.1	2010-12-22	The USB hub is working in bus powered mode. For information on how to use self powered mode please see: https://support.bluetechnix.at/wiki/Known_Issues_(SBC-i.MX51)
2.1	2010-12-22	Using the USB OTG in device mode applies 5 volts on the USB port (Pin x) which doesn't comply with the USB-OTG standard. It may lead to small equalizing currents.
1.0	2009 12 03	No anomalies reported yet.

Table 10-2: Overview product anomalies

11 Document Revision History

Version	Date	Document Revision
6	2011-08-31	Changed product illustration.
5	2011-08-22	Updated illustration 4.1. Added new anomaly.
4	2011-04-21	Changed product illustration. Updated table 4-2, 4-4, 4-7 and 4-8.
3	2010-12-22	Updated anomalies.
2	2010-06-24	Update for Board Revision V2.1
1	2010-05-11	First draft release.

Table 11-1: Revision History

12 List of Abbreviations

Abbreviation	Description
ADI	Analog Devices Inc.
AI	Analog Input
AMS	Asynchronous Memory Select
AO	Analog Output
CM	Core Module
DC	Direct Current
DSP	Digital Signal Processor
eCM	Enhanced Core Module
EBI	External Bus Interface
ESD	Electrostatic Discharge
GPIO	General Purpose Input Output
I	Input
I^2C	Inter-Integrated Circuit
I/O	Input/Output
ISM	Image Sensor Module
LDO	Low Drop-Out regulator
MTBF	Mean Time Between Failure
NC	Not Connected
NFC	NAND Flash Controller
O	Output
OS	Operating System
PPI	Parallel Peripheral Interface
PWR	Power
RTOS	Real-Time Operating System
SADA	Stand Alone Debug Agent
SD	Secure Digital
SoC	System on Chip
SPI	Serial Peripheral Interface
SPM	Speech Processing Module
SPORT	Serial Port
TFT	Thin-Film Transistor
TISM	Tiny Image Sensor Module
TSC	Touch Screen Controller
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus
USBOTG	USB On The Go
ZIF	Zero Insertion Force

Table 12-1: List of abbreviations

13 List of Figures and Tables

Figures

Figure 1-1: SBC-i.MX51 features ... 9
Figure 1-2: SBC-i.MX51 overview ... 10
Figure 3-1: Standard interface positions ... 13
Figure 3-2: LED and button positions ... 14
Figure 4-1: Extension Connector positions ... 15
Figure 4-2: GPIO/Automation Extension Connector interfaces ... 16
Figure 4-3: LED connection circuit ... 17
Figure 4-4: Digital video connector ... 21
Figure 6-1: Connector dimensions ... 28
Figure 6-2: Mounting-hole dimensions ... 29

Tables

Table 4-1: Maximum power consumption for the GPIO / automation connector supplies ... 18
Table 4-2: Power domains for I/O ... 19
Table 4-3: GPIO / automation connector pin description ... 20
Table 4-4: CSI1 interface description ... 21
Table 4-5: DISP2 interface description ... 21
Table 4-6: GPIO Power Domains ... 22
Table 4-7: Maximum power consumption for the digital video connector supplies ... 22
Table 4-8: Digital video connector pin description ... 24
Table 4-9: Audio extension connector pin description ... 24
Table 4-10: Reset / Power-on connector pin description ... 25
Table 4-11: Power supply extension connector pin description ... 25
Table 5-1: Operating conditions ... 26
Table 5-2: Digital IO characteristics ... 26
Table 5-3: ADC characteristics ... 27
Table 5-4: Boot modes ... 27
Table 8-1 - Ordering information ... 31
Table 10-1: Overview product changes ... 33
Table 10-2: Overview product anomalies ... 33
Table 11-1: Revision History ... 34
Table 12-1: List of abbreviations ... 35